State of California
The Resources Agency
Department of Water Resources

MATRIX OF LIFE HISTORY AND HABITAT REQUIREMENTS FOR FEATHER RIVER FISH SPECIES SP-F3.2 TASK 2 SP-F21 TASK 1

LARGEMOUTH BASS

Oroville Facilities Relicensing FERC Project No. 2100

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Element	Element Descriptor	General	Feather River specific
General			
common name (s)	English name (usually used by fishers and laypeople).	Largemouth bass, largemouth black bass	
scientific name (s)	Latin name (referenced in scientific publications).	The scientific name of largemouth bass is *Micropterus salmoides* (Moyle 2002).	
taxonomy (family)	Common name of the family to which they belong. Also indicate scientific family name.	Largemouth bass belong to the *Centrarchidae* family (Moyle 2002). The *Centrarchidae* family includes sunfishes, crappies, and basses. Fishes of genus *Micropterus* are collectively referred to as "black basses" (Moyle 2002).	
depiction	Illustration, drawing or photograph.		
range	Broad geographic distribution, specifying California distribution, as available.	Largemouth bass are widely distributed in the continental U.S, Hawaii, and most provinces in Canada. Largemouth bass are also established in locations throughout Europe, Japan, Korea, Algeria, Botswana, South Africa, Swaziland, Tanzania, Uganda, Zimbabwe, all Central American countries, Bolivia, Brazil, Colombia, Mauritius, New Caledonia, and many other countries (Moyle 2002).	
native or introduced	If introduced, indicate timing, location, and methods.	Largemouth bass were reportedly introduced to California from Illinois in 1891 (Moyle 2002).	In California, largemouth bass were planted in Cuyamaca Reservoir and in the Feather River. They were distributed statewide by anglers and biologists (Moyle 2002).
ESA listing status	Following the categories according to California Code of Regulations and the Federal Register, indicate whether: SE = State-listed Endangered; ST =State-listed Threatened; FE = Federally listed Endangered; FT = Federally-listed Threatened; SCE = State	Largemouth bass are not a listed species (DFG 2002).	

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	Candidate (Endangered); SCT = State candidate (Threatened); FPE = Federally proposed (Endangered); FPT = Federally proposed (Threatened); FPD = Federally proposed (Delisting); the date of listing; or N = not listed.		
species status	If native, whether: Extinct/extirpated; Threatened or Endangered; Special concern; Watch list; Stable or increasing. If introduced, whether: Extirpated (failed introduction); highly localized; Localized; Widespread and stable; Widespread and expanding.	In freshwater, largemouth bass are "widespread and stable" (Moyle 2002).	
economic or recreational value	Indicate whether target species sought for food or trophy. Whether desirable by recreational fishers, commercial fishers, or both.	Largemouth bass are desired by recreational anglers. Largemouth bass are a favorite game fish throughout the United States, including California reservoirs and sloughs, and support large fishing tournaments (Moyle 2002).	
warmwater or coldwater	Warmwater if suitable temperature range is similar to basses; coldwater if suitable temperature range is similar to salmonids.	Largemouth bass are a warmwater species (Moyle 2002).	
pelagic or littoral	Environment: Pelagic - living far from shore; Littoral - living near the shore.	Largemouth bass are littoral (Moyle 2002). In reservoirs and lakes, largemouth bass reportedly remain close to the shore and seem to be most abundant in water 1-3 meters deep (Moyle 2002).	
bottom or water column distribution	Environment: bottom (benthic) or along water column.	Largemouth bass inhabit the water column (Moyle 2002). Largemouth bass reportedly inhabit warm, shallow waters less than 19.7 ft (6 m) deep (Moyle 2002).	
lentic or lotic	Environment: Lentic - pertaining to stagnant water, or lake-like; Lotic - moving water, or river-like.	Largemouth bass are a lentic species (Moyle 2002).	

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Adults			
life span	Approximate maximum age obtained.	Largemouth bass have been reported to live to a maximum age of 16 years. In California reservoirs, the average lifespan reportedly is 4-5 years (Moyle 2002). Largemouth bass reportedly can live to a maximum age of 23 years (Green and Heidinger 1994). In the Northern U.S., largemouth bass reportedly live up to 15 years, while in the Southern U.S., largemouth bass reportedly live up to 11 years (Davis and Lock 1997).	
adult length	Indicate: Length at which they first reproduce; average length and maximum length the fish can attain.	The maximum length largemouth bass attain reportedly is 29.9 inches (76 cm) TL. In California reservoirs, average length reportedly ranges from 13.8-17.7 inches (35-45 cm). Males typically spawn at lengths reportedly ranging from 7.1-8.3 inches (18-21 cm), while females spawn at lengths reportedly ranging from 7.9-9.8 inches (20-25 cm) (Moyle 2002) Largemouth bass reportedly range in length from 4 inches (102 mm) at age 1 to 20.2 inches (514 mm) at age 15 (Beamesderfer and North 1995).	
adult weight	Indicate: Weight at which they first reproduce; average weight and maximum weight the fish can attain.	The reported maximum weight attained by largemouth bass is 23.1 pounds (10.5 kg). In California reservoirs, largemouth bass reportedly average 1.3-4.9 pounds (0.6-2.2 kg) (Moyle 2002).	
physical morphology	General shape of the fish: elongated, fusiform, laterally compressed, etc.	Largemouth bass are elongated and become deeper bodied with age (Moyle 2002).	
coloration	Indicate color, and color changes, if any, during reproduction phase.	Largemouth bass are typically olive gray to shiny green on the back and sides, and white on the belly, with a stripe in between. Largemouth bass have brown eyes (Moyle 2002).	
other physical adult descriptors	Unique physical features for easy identification.	Largemouth bass have a large mouth with maxillae that extend to or past the hind margin of	

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		the eyes (Moyle 2002).	
adult food base	Indicate primary diet components.	At lengths ranging from 2.0-2.4 inches (50-60 mm) SL, largemouth bass reportedly feed on aquatic insects, and fish fry. At lengths ranging from 3.9-4.9 inches (100-125 mm) SL, largemouth bass reportedly feed on fish, crayfish, tadpoles, and frogs. In California reservoirs, adults reportedly feed on threadfin shad, golden shiners and bluegill (Moyle 2002). Adult largemouth bass reportedly feed on invertebrates and a variety of fish (Miller and Storck 1984). Adult largemouth bass reportedly feed on green sunfish and bluegill (Savitz and Janssen 1982). The food base for adult largemouth bass reportedly consists of sunfish, bluegill, glut herring, golden shiner, coastal shiner, yellow and brown bullheads, mosquitofish, brook silverside, yellow perch, Cyprus darter, damsel and dragonfly nymphs, midge and mayfly larvae, leeches, crayfish, and plant material (Bennet and Gibbons 1972).	
adult feeding habits	Indicate whether plankton eater, algae eater, bottom feeder, piscivorous, active hunter, ambush predator, filter feeder. Night, day, dusk or dawn feeder.	Adult largemouth bass reportedly are solitary hunters (Moyle 2002). Adult largemouth bass over 2.4 inches (60 mm) in length reportedly may be piscivorous (Bettoli et al. 1992).	
adult in-ocean residence time	For anadromous species, age when they migrate to the ocean and duration spent in the ocean before returning to freshwater to spawn.		
adult habitat characteristics in-ocean	For anadromous species, description of the ocean habitat utilized: whether along major current systems, gyres, pelagic (beyond continental shelves)		

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	and neritic (above continental shelves) zones, etc.		
Adult upstream migration (immigration)			
range of adult upstream migration timing	Time of year adults migrate upstream. If applicable, indicate for various runs.		
peak adult upstream migration timing	Time of year most adults migrate upstream. If applicable, indicate for various runs.		
adult upstream migration water temperature tolerance	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
adult upstream migration water temperature preference	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.		
Adult holding (freshwater residence)			
water temperature tolerance for holding adults	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Reported optimal water temperatures for largemouth bass growth range from 77°F-86°F (25°C-30°C). Adult largemouth bass reportedly can exist in water temperatures as high as 96.8°F-98.6°F (36°C-37°C) (Moyle 2002). Water temperatures tolerated by largemouth bass reportedly range from 77°F-86°F (25°C-30°C) (Coutant and DeAngelis 1983). In winter and fall in South Carolina, largemouth bass tolerate water temperatures reportedly ranging from 60.8°F-77°F (16°C -25°C) (Bennet and Gibbons 1972).	
water temperature preference for holding adults	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental.	Reported optimal water temperature for largemouth bass is 80.6°F (27°C) (Moyle 2002). Suitable water temperatures for largemouth bass reportedly range from 77°F-84.2°F (25°C -29°C) (Coutant and DeAngelis 1983).	

Element	Element Descriptor	General	Feather River specific
water depth range for holding adults	Reported range of observed (minimum and maximum) water depth utilization.	Adult largemouth bass reportedly reside in water depths ranging from 3.3-9.8 ft (1-3 m) (Moyle 2002).	
water depth preference for holding adults	Reported range of most frequently observed water depth utilization.	Largemouth bass adults reportedly prefer water depths less than 19.7 ft (6 m) (Moyle 2002).	
substrate preference for holding adults	If bottom dwellers, indicate substrate: mud, sand, gravel, boulders, aquatic plant beds, etc. If gravel, indicate range or average size of gravel.	Adult largemouth bass reportedly prefer warm, shallow waters of moderate clarity and beds of aquatic plants. Largemouth bass are found in farm ponds, lakes, reservoirs, sloughs, and river backwaters where other nonnative fish are abundant, and where there is heavy growth of aquatic plants (Moyle 2002).	
water velocity range for holding adults	Reported range of observed (minimum and maximum) water velocity utilization.	Largemouth bass reportedly utilized water current velocities averaging 2-19 cm/s in the La Grange Reach of the Illinois River (Raibley et al. 1997).	
water velocity preference for holding adults	Reported range of most frequently observed water velocity utilization.	In eight of the study areas where largemouth bass wintered in the La Grange Reach of the Illinois River, largemouth bass reportedly occupied locations with a mean current velocity of 1.6 cm/s (Raibley et al. 1997).	
other habitat characteristics for holding adults	General description of habitat (e.g. turbid or clear waters, lentic or lotic, presence of aquatic plant beds, debris, cover, etc.).	In native habitats, largemouth bass are reported to live in estuarine conditions with salinities up to 16 ppt. In California, it is reportedly unusual to find largemouth bass in salinities much higher than 3 - 5 ppt, and they are abundant in tidally influenced freshwater sloughs of the Delta (Moyle 2002).	
timing range for adult holding	Time of year (earliest-latest) and duration of stay from upstream migration to spawning.	Largemouth bass reportedly wintered during November through March in the La Grange Reach of the Illinois River (Raibley et al. 1997).	
timing peak for adult holding	Time of year when maximum number of adults are present before spawning.		
Spawning			
fecundity	Average or range in the number of eggs females lay in a spawning season.	Female largemouth bass reportedly lay between 2,000-110,000 eggs per female. Fecundity reportedly increases with age, weight and length of female (Wang 1986).	

Element	Element Descriptor	General	Feather River specific
		A female largemouth bass may reportedly lay between 2,000-94,000 eggs, depending on body size (Moyle 2002). Average fecundity is reportedly approximately 4,000 eggs per pound of body weight; up to 80,000 eggs per female has been reported (Davis and Lock 1997).	
nest construction	Location and general description of nest -- substrates, aquatic plants, excavations, crevices, habitat types, etc.	Largemouth bass nests reportedly are shallow depressions up to 3.3 ft (1 m) in diameter in sand, gravel, or debris littered bottoms at depths of 1.6-6.6 ft (0.5-2 m). Nests are reportedly often built next to submerged objects, logs or boulders (Moyle 2002).	
nest size	Size and average dimensions of the nest.	The largemouth bass nest is circular and its diameter is reportedly approximately twice the body length of the male (Davis and Lock 1997).	
spawning process	Indicate whether nest builder, broadcast spawner, or other.	Largemouth bass are nest builders (Moyle 2002).	
spawning substrate size/characteristics	Range of substrates used during spawning (e.g. mud, sand, gravel, boulders, beds of aquatic plants). Indicate presence of plant/wood debris, crevices at spawning sites. If gravel, indicate range of average size.	Largemouth bass spawning reportedly occurs mostly over gravel, sand, and mud substrate below boulders (Wang 1986). Largemouth bass spawning reportedly occurs next to submerged objects, such as logs or boulders (Moyle 2002). Largemouth bass spawning reportedly occurs over firm substrate such as sand, gravel or clay. Nests have also reportedly been observed on tree roots, on clumps of aquatic vegetation and in pits in compacted mats of dead, fibrous aquatic vegetation (Bruno et al. 1990). Largemouth bass spawning reportedly occurs over hard substrates such as sand or gravel and under cover or any form of structure that is available (Davis and Lock 1997).	

Element	Element Descriptor	General	Feather River specific
preferred spawning substrate	Indicate preferred spawning substrate (e.g. mud, sand, gravel, boulders, plant bed, etc).		
water temperature tolerance for spawning	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Largemouth bass spawning reportedly begins at water temperatures ranging from 57.2°F-60.8°F (14°C-16°C) and reportedly occurs in water temperatures up to 75.2°F (24°C) (Wang 1986). Largemouth bass nest building reportedly begins at water temperatures of 59°F-60.8°F (15°C-16°C) and spawning reportedly continues to water temperatures of 75.2°F (24°C) (Moyle 2002). Largemouth bass spawning reportedly occurs at water temperatures ranging from 53.6°F-68°F (12°C-20°C) (Miller and Storck 1984). In laboratory conditions, largemouth bas spawning reportedly occurred at 68°F (20°C) (Carlson 1973). Largemouth bass spawning reportedly occurs at water temperatures ranging from 65°F-75°F (18.3°C-23.9°C) (Davis and Lock 1997). Water temperatures over the nests of largemouth bass within the Hudson River reportedly ranged from 62.1°F -68.9°F (16.7°C –20.5°C) (Nack et al. 1993).	
water temperature preference for spawning	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	Water temperatures over the nests within the Hudson River reportedly averaged 64.4°F (18°C) (Nack et al. 1993).	
water velocity range for spawning	Minimum and maximum speed of water current the spawning fish can tolerate.		

Element	Element Descriptor	General	Feather River specific
water velocity preference for spawning	Preferred water current (flow velocity) during spawning.		
water depth range for spawning	Reported range of observed (minimum and maximum) water depth utilization.	Mean nest depth for largemouth bass reportedly is 2 ft (0.6 m) (Sammons et al. 1999). Largemouth bass spawning reportedly occurs at water depths of 1.6-6.6 ft (0.5-2 m). In California, with changing reservoir levels, spawning has reportedly been observed at water depths up to 13.1-16.4 ft (4-5 m) (Moyle 2002). Largemouth bass spawning reportedly occurs in water 1-4 ft (0.3-1.2m) deep near shore and has been observed as deep as 20 ft (6.1m) in clear water (Davis and Lock 1997). The depth of the nests found at low tide within the Hudson River reportedly ranged from 1.6 to 3.6 ft (0.5 to 1.10 m) (Nack et al. 1993).	
water depth preference for spawning	Reported range of most frequently observed water depth utilization.	The average depth at which largemouth bass nests were found in the Hudson River reportedly was 1.9 ft (0.58m) (Nack et al. 1993).	
range for spawning timing	Earliest and latest time of season or year in which spawning occurs.	Largemouth bass spawning reportedly occurs from April to June (Wang 1986). In southern California, largemouth bass spawning reportedly may begin as early as March, while spawning in northern California generally begins in April. Spawning reportedly lasts through June (Moyle 2002). Largemouth bass spawning reportedly occurs over approximately 45 days from late April to early June (Miller and Storck 1984).	
peak spawning timing	Time of year most fish start to spawn.	Peak largemouth bass spawning reportedly occurs in early May (Wang 1986).	
spawning frequency (iteroparous/semelpa	Semelparous - producing all offspring at one time, such as in most salmon.	Largemouth bass are iteroparous (Moyle 2002).	

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rous)	Usually these fish die after reproduction. Iteroparous - producing offspring in successive, e.g., annual or seasonal batches, as is the case in most fishes.		
Incubation/early development			
egg characteristics	Shape, size, color, in clusters or individuals, stickiness, and other physical attributes.	Largemouth bass eggs are spherical, ranging from 0.06-0.07 inches (1.5-1.7 mm) in diameter. Largemouth bass eggs are reportedly adhesive, transparent, thin, and demersal (Wang 1986).	
water temperature tolerance for incubation	Range of water temperatures allowing survival. Indicate stressful or lethal levels.	Largemouth bass nest success was reportedly reduced if water temperature was reduced below 60°F (15.5°C) (Davis and Lock 1997). Largemouth bass eggs hatch at water temperatures reportedly ranging from 55.4°F–69.8°F (13°C-21°C) (Sammons et al. 1999).	
water temperature preference for incubation	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.	Largemouth bass eggs were reportedly collected at 57.2°F -64.8°F (14.0°C -18.2°C(Wang 1986). Initiation of largemouth bass hatch within the Normandy Reservoir reportedly occurred in water temperatures ranging from 55.4°F-69.8°F (13°C - 21°C) (Sammons et al. 1999).	
time required for incubation	Time duration from fertilization to hatching. Note: Indicate at which temperature range. Incubation time is temperature-dependent.	Largemouth bass eggs reportedly hatch in 5 days at water temperatures of 66°F (18.9°C), while eggs reportedly hatch in 2 days at water temperatures of 72°F (22.2°C) (Wang 1986). Largemouth bass eggs reportedly hatch in 2-7 days and sac fry spend 5-8 days in the nest (Moyle 2002). Largemouth bass eggs reportedly hatch in 2-4 days in the southern U.S., depending on water temperature (Davis and Lock 1997).	
size of newly hatched larvae	Average size of newly hatched larvae.	Newly hatched largemouth bass larvae may reportedly be as small as 0.09 inches (2.3 mm) TL. Recently hatched largemouth bass collected	

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		in the field reportedly range from 0.14-0.16 inches (3.6-4.1 mm) total length (Wang 1986).	
time newly hatched larvae remain in gravel	Time of year of hatching, and duration between hatching and emergence from gravel.	Hatching of largemouth bass eggs reportedly occurs from early April through early June (Sammons et al. 1999).	
other characteristics of larvae	Alevin -- early life history phase just after hatching (larva) when yolk-sac still present.		
timing range for emergence	Time of year (earliest-latest) hatchlings (larvae and alevins) leave or emerge from the nesting/hatching (gravel) sites.	The swim-up stage of largemouth bass reportedly occurs in early May to mid-June in Lake Shelbyville (Miller and Storck 1984).	
timing peak for emergence	Time of year most hatchlings emerge.		
size at emergence from gravel	Average size of hatchlings at time of emergence.	Mean lengths of largemouth bass collected in cove rotenone samples in Normandy Reservoir reportedly ranged from 45-61mm (Sammons et al. 1999).	
Juvenile rearing (in freshwater)			
general rearing habitat and strategies	General description of freshwater environment and rearing behavior.	Young-of-year and yearling largemouth bass reportedly stay close to the shore in schools that cruise above or near aquatic plant beds. Schools of juvenile largemouth bass reportedly remain in limited areas and are more active during the day than at night (Moyle 2002).	
water temperature tolerance for juvenile rearing	Extreme water temperatures rearing juveniles can survive. Indicate whether these extremes are stress or lethal levels.	Reported optimal range of water temperatures for juvenile largemouth bass range from 77°F-86°F (25°C-30°C) (Coutant and DeAngelis 1983). Largemouth bass growth can occur over a wide range of water temperatures, ranging from 50°F-95°F (10°C -35°C) (Moyle 2002).	
water temperature preference for juvenile rearing	Optimum temperature range for rearing juveniles for growth.	Reported optimal water temperatures for growth of largemouth bass over 3.9 inches (10 cm SL) are 77°F-86°F (25°C -30°C), but juvenile largemouth bass reportedly prefer water temperatures ranging from 86°F-89.6°F (30°C -32°C) (Moyle 2002).	

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		In laboratory conditions, largemouth bass juveniles reportedly prefer water temperatures of 80.6°F (27°C) (Coutant and DeAngelis 1983).	
water velocity ranges for rearing juveniles	Minimum and maximum water velocities (flows and currents) the rearing juveniles can tolerate.		
water velocities preferred by rearing juveniles	Optimum range of water velocities for rearing juveniles.		
water depth range for juvenile rearing		Young-of-year and yearling largemouth bass reportedly stay close to the shore in schools (Moyle 2002).	
water depth preference for juvenile rearing			
cover preferences for rearing juveniles	Type of cover for protection from predator used by rearing juveniles (e.g. crevices, submerged aquatic vegetation, overhanging vegetation, substrate cover, undercover bank, small woody debris, large woody debris).	Young-of-year and yearling largemouth bass reportedly cruise above or near aquatic plant beds (Moyle 2002).	
food base of juveniles	Indicate primary diet components, i.e. what they eat. Also indicate the diet changes, if any, as they grow.	Largemouth bass fry reportedly feed on rotifers and small crustaceans, and by the time the largemouth bass reach 1.9-2.4 inches (50-60 mm) SL, they primarily feed on aquatic insects and fish fry, including fry of their own species. When juvenile largemouth bass reach 3.9-4.9 inches (100-125 mm) SL, they reportedly feed mainly on fish (Moyle 2002). Largemouth bass fry reportedly feed on small crustaceans, while young feed on crustaceans, insects and other fish (Dill 1948). Juvenile largemouth bass reportedly feed on aquatic insect, amphipods, and grass shrimp (Bettoli et al. 1992).	

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feeding habits of rearing juveniles	Indicate: Plankton eaters, bottom feeders, piscivorous, active hunters, ambush predators, filter feeders. Night, day, dusk or dawn feeders. Also indicate change of feeding habits as they grow.	Juvenile largemouth bass are active hunters, reportedly capable of changing foraging behavior in accordance with prey availability, type of habitat, experience and body size; active most of the day and moonlit nights (Moyle 2002).	
predation of juveniles	Indicate which species prey on juveniles.		
timing range for juvenile rearing	Range of time of year (months) during which rearing occurs.		
timing peak for juvenile rearing	Time of year (months) during which most rearing occurs.		
Juvenile emigration			
time spent in fresh water prior to emigrating	Duration (in years and/or months) from emergence to emigration to the ocean.		
water temperature tolerances during emigration	Range of water temperatures allowing survival. Indicate stressful or lethal levels.		
water temperature preferences during emigration	Range of suitable, preferred or reported optimal water temperatures. Indicate whether literature, observational, or experimental derivation.		
emigration timing range	Time of year juveniles commence emigration and duration of emigration		
emigration timing peak	Time of year most juveniles are emigrating.		
size range of juveniles during emigration	Minimum and maximum sizes (inches or mm) of emigrating juveniles. Indicate average size.		
factors associated with emigration	Pulse flows, water temperature changes, turbidity levels, photoperiod, etc.		

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Other potential factors			
DO	Levels of dissolved oxygen in water expressed in mg/L tolerated by fish.	Largemouth bass reportedly can persist in water temperatures ranging from 96.8°F-98.6°F (36°C - 37°C) during the day with dissolved oxygen levels as low as 1 mg/L (Moyle 2002).	
pH	Alkalinity/acidity of water (expressed in pH) that fish can tolerate.	The maximum pH tolerated by largemouth bass reportedly is pH 9 (Moyle 2002).	
turbidity	Indicate turbidity or state of water (e.g., clear water or presence of siltation or organic/inorganic matter in water) that fish can tolerate.	Largemouth bass typically inhabit warm, shallow water of moderate clarity (Moyle 2002).	
factors contributing to mortality	e.g., fishing/angling mortality, drastic habitat alterations, unfavorable climatic changes, etc.	Fishing and angling are sources of mortality for largemouth bass (Green 1995). Overfishing, reservoir aging, and competition are factors contributing to largemouth bass mortality (Moyle 2002).	
Predation-related characteristics			
consumption rates by size	Rate of consumption of prey by predator size.	Under laboratory conditions, largemouth bass reportedly have not been observed to ingest prey of body depth greater than their own external mouth width (Hambright 1991). Relative size of predators to prey reportedly reaches 40% to 50% for young predators, 20% to 25% for adult predators, and only 10% for very large predators (Lewis et al. 1974).	
consumption rates by lifestage	Rate of consumption of prey by predator lifestage.		
consumption rates by water temperature	Rate of consumption of prey by water temperature.	Reportedly, largemouth bass do not feed at water temperatures below 50°F (10°C) (Adams et al. 1982). Food consumption of largemouth bass increases at warmer water temperatures. In a laboratory study, mean group consumption (N=5) of fathead minnows over 36 days for large (5.4-5.5 inches (136-140 mm)) largemouth bass reportedly was 0.14 oz/day (3.9 g/day) at 57.2°F (14°C), 0.3	

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		oz/day (8.6 g/day) at 68°F (20°C), and 0.87oz/day (24.6 g/day) at 78.8°F (26°C). Small (108-113 mm) largemouth bass consumed fathead minnows at a rate of 0.11 oz/day (3.0 g/day) at 57.2°F (14°C), 0.18 oz/day (5.0 g/day) at 68°F (20°C), and 0.64 oz/day (18.2 g/day) at 78.8°F (26°C) in a 24 hour period (Smagula and Adelman I.R. 1982).	
growth rate	Rate at which growth occurs.	Approximately 5 pounds (2.3 kg) of forage are required for annual largemouth bass maintenance, and approximately 10 pounds (4.5 kg) of forage are required for a largemouth bass to gain 1 pound (0.45 kg) (Davis and Lock 1997).	
community interactions (predators)	Known predators.		
community interactions (prey)	Known prey.	In California reservoirs, largemouth bass reportedly feed largely on threadfin shad, golden shiners, and bluegill (Moyle 2002). Largemouth bass is considered a probable "keystone" predator in some localities. A keystone species causes changes throughout the ecosystem, usually by changing abundances of favored prey. Although poorly documented, the decline and disappearance of native minnows followed their introductions, such as into Clear Lake (Moyle 2002). Largemouth bass reportedly prey on invertebrates and miscellaneous fish (Miller and Storck 1984). Largemouth bass reportedly prey on green sunfish and bluegill (Savitz and Janssen 1982). In Crab Orchard Lake, Illinois, gizzard shad, bullheads, crayfish, centrarchids reportedly constitute largemouth bass prey (Lewis et al.	

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		1974).	
community interactions (competitors)	Known competitors.	Threadfin shad reportedly compete with largemouth bass in early life stages (Moyle 2002).	
predator diet by size	Diet of fish by size classes.	In California, for the first few months following hatching, largemouth bass reportedly feed primarily on rotifers and small crustaceans. By the time largemouth bass reach 2-2.4 inches (50-60 mm) SL, the diet reportedly shifts to largely aquatic insects and fish fry, including their own species. At 3.9-4.9 inches (100-125 mm) SL, largemouth bass reportedly subsist primarily on fish. (Moyle 2002). In Lake Conroe, Texas, fish reportedly constituted the majority of the diet of largemouth bass ranging in length from 1.6-2.4 inches (41-60 mm), and all largemouth bass over 2.4 inches (60 mm) consumed only fish. The most commonly identified fish consumed by largemouth bass was silverside and the most commonly identified fish in larger largemouth bass was shad (Bettoli et al. 1992). Based on stomach content analysis of 50 individuals 6.3-19.3 inches (16-49 cm) long, largemouth bass in the Sacramento –San Joaquin Delta reportedly consumed the following prey : (1) crustaceans including Mysid shrimp (*Neomysis awatschensis*), amphipods (*Corophium*), and crayfish (*Pacifastacus leniusculus*); (2) insects including tendipedids; (3) amphibians including bullfrog (*Rana catesbeiana*); and (4) fish including threadfin shad (*Dorosoma petenense*), Chinook salmon (*O. tshawytscha*), bluegill (*Lepomis macrochirus*), black crappie (*Pomoxis nigromaculatus*), and other unidentified fish (Turner 1966).	

Element	Element Descriptor	General	Feather River specific
predator diet by age group	Diet of fish by age group.		
association of predators to physical facilities including habitat conditions created by operations	Habitat conditions created by operations that are conducive to predation (velocities, temperatures).	Through a literature review, it was concluded that Columbia River impoundments increase availability of microhabitats within the range preferred by northern pikeminnow and other predators (smallmouth and largemouth bass) (NOAA 2000).	
association of predators to physical facilities including instream flow obstructions/diversions	Instream flow obstructions and/or diversions associated with structures and facilities that are conducive to predation.	Dam-related passage problems and reduced river discharge can affect the availability, distribution, timing, and aggregation of migrating salmons, thereby increasing exposure time to predation. In particular, increasing exposure time later in the season when predator (smallmouth and largemouth bass) consumption rates are high may increase predation (NOAA 2000).	
association of predators to physical facilities including unusual flow and/or water temperature patterns	Flow or water temperature associated with structures, or operations facilities that are conducive to predation.	Through literature review, it was concluded that Columbia River, impoundments increase local water temperatures which increases digestion and consumption rates by pikeminnow and other predators (smallmouth and largemouth bass) (NOAA 2000).	

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